

Novelty lamp box

A-15

PATENT OFFICE

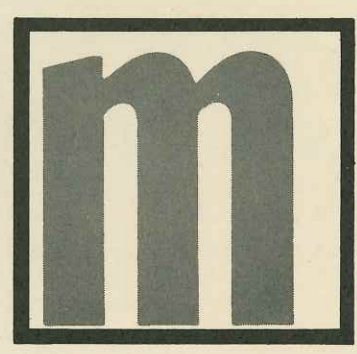
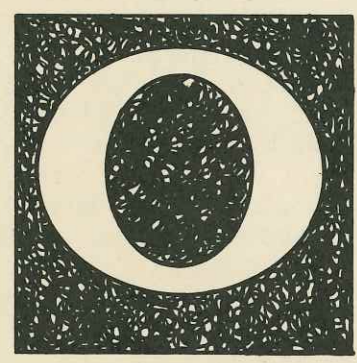
OCT 16 1959

DIVISIONS 81 & 82

Rockets

army ordnance missile command

DESIGN DIV.
RETURN TO

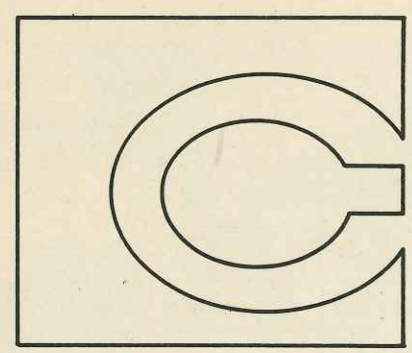
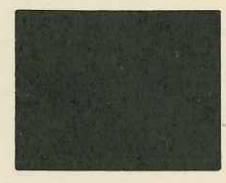


MISSILES AND SPACE

PATENT OFFICE

OCT 16 1959

DIVISIONS 81 & 82



RETURN TO
DESIGN DIV.

The Army Ordnance Missile Command is responsible for the entire family of Army rockets and missiles, from the Little John rocket to the powerful Jupiter. The Command is responsible for the most effective use of all the resources available to the Army in the missile field. It supports each system from the drawing board to the field, as long as it is operational -- whether it is in the hands of Army troops, the other armed services, or the forces of allied nations.

While the challenge of outer space has overshadowed the significance of the missile systems, the primary objective of the Command is to equip the Army with weapons that will enable the combat arms to defeat any aggressor, in any type of conflict, in any environment.

The Command was formed on March 31, 1958, and is commanded by Maj. Gen. J. B. Medaris. Redstone Arsenal, near Huntsville, Ala., is the location of Command Headquarters, and two major elements of the Command, the Army Ballistic Missile Agency, and the Army Rocket and Guided Missile Agency. A third major element is the White Sands Missile Range, in New Mexico. The Missile Firing Laboratory of ABMA launches the larger missiles and Army-oriented space probes from Cape Canaveral, Fla.

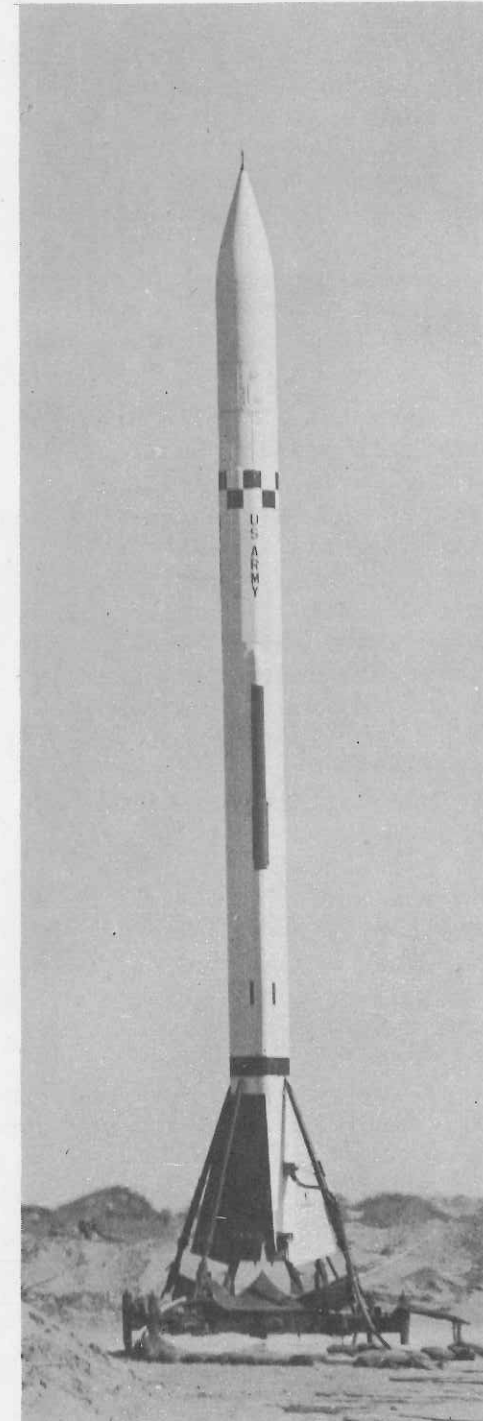
Total personnel strength in the Command is about 25,000, of whom 4,500 are military, and 21,500 are civilians. Its annual budget provides for the intelligent investment of approximately two billion dollars of the taxpayer's money in defense efforts.

Some of the Army's missile systems and achievements in space exploration are described briefly in the following pages.



a real old timer...

CORPORAL MISSILE



Equipped with either an atomic or conventional type warhead, the Army Corporal is a surface-to-surface guided missile capable of engaging tactical targets within a range of 75 miles.

Using red fuming nitric acid and aniline as fuel, it zooms over a ballistic trajectory in its flight to the target faster than the speed of sound. Bad weather and poor visibility do not restrict its use.

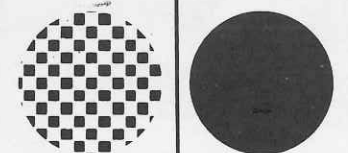
The missile is 45 feet long, and is carried into the field on a self-propelled, hydraulically-operated erector. The missile is fueled and the warhead mated in the horizontal position. The erector places the Corporal in a vertical firing position on a small take-off pedestal. Other ground equipment includes fuel trucks, air compressor, air storage tanks, and a movable servicing platform.

The system is produced by the Firestone Tire and Rubber Company and Gilfillan Brothers, Inc., under direction of the Army Rocket and Guided Missile Agency. It has been in the field for more than five years.

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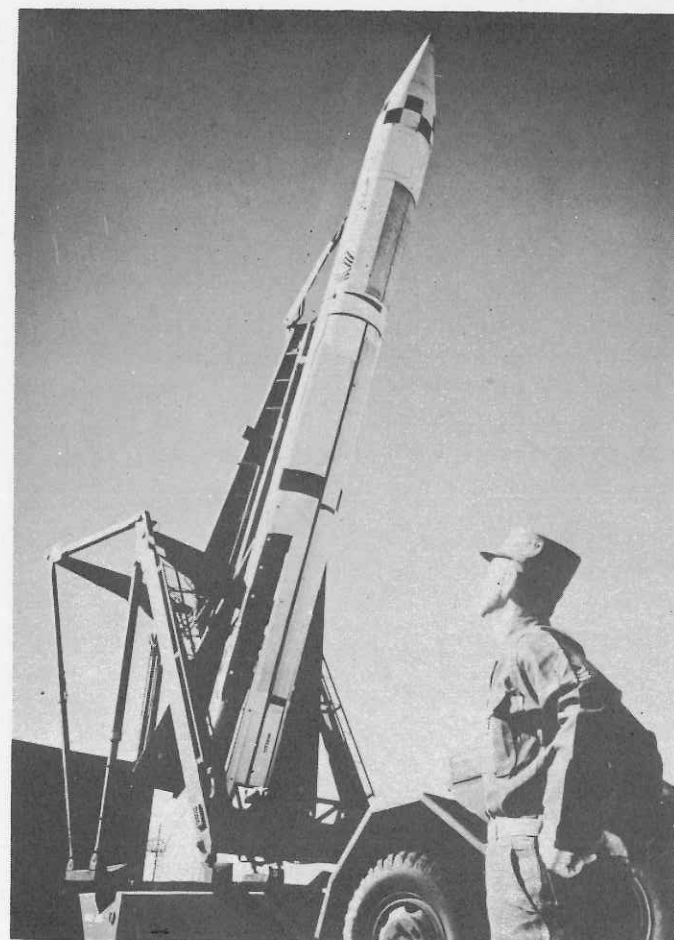
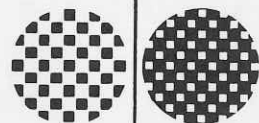
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DIVISIONS 81 & 82



up and coming...

SERGEANT MISSILE



The Sergeant, a solid propellant ballistic missile designed to replace the Corporal, will outrank the Corporal in power, accuracy, and mobility. Overall length of the Sergeant is about 30 feet.

It can deliver a nuclear blow far behind enemy lines, and its highly accurate guidance system is invulnerable to any known countermeasures. The Sergeant solid propellant motor has better performance and storage capabilities than those of many other weapons.

The Sergeant can be quickly emplaced and fired by a small crew under all conditions of weather and terrain. The missile and all its ground equipment can easily be moved by standard Army vehicles. The use of solid propellants and advanced techniques for guidance have made it extremely simple to maintain and fire the weapon.

It was designed and developed by the Jet Propulsion Laboratory, California Institute of Technology, under direction of the Army Rocket and Guided Missile Agency. Sperry, Utah, has been awarded production contract.

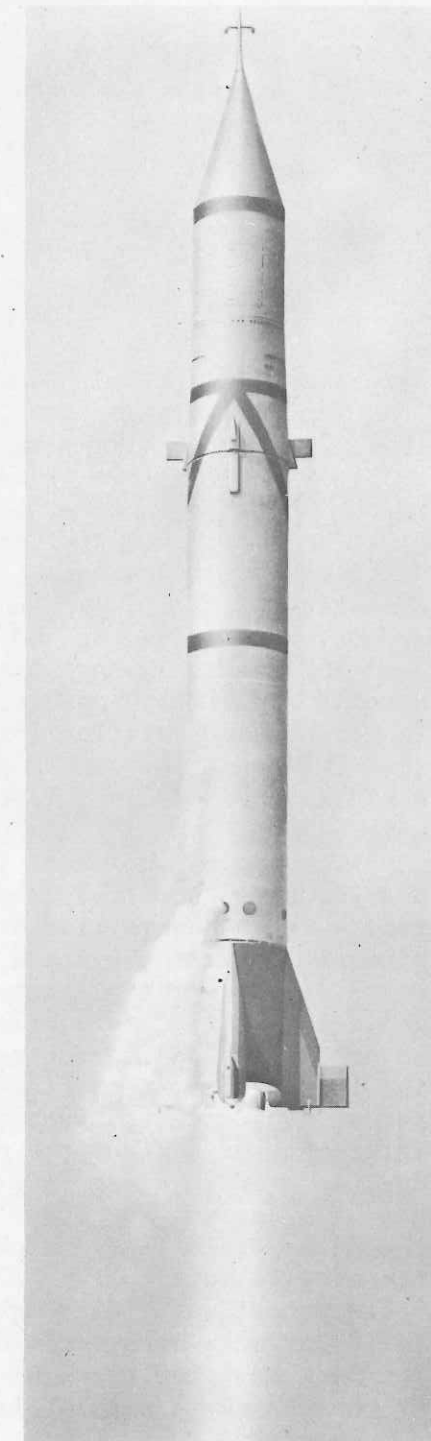
army's "Sunday Punch"...

REDSTONE BALLISTIC MISSILE

The Redstone has been called the Army's "true Sunday punch" by Maj. Gen. J. B. Medaris, Commanding General of the Army Ordnance Missile Command. The reliable Redstone is a liquid propelled, surface-to-surface ballistic missile which can place a nuclear or conventional warhead with extreme accuracy on targets up to 200 miles away. The missile is 69 feet long and 70 inches in diameter. Named for its birthplace, Redstone Arsenal, it was developed by the Army Ballistic Missile Agency's team of scientists, engineers, and technicians under the technical direction of Dr. Wernher von Braun. Chrysler Corporation is the prime production contractor. The

40th Field Artillery Missile Group (Redstone) has been in Europe for some time to bolster NATO shield forces for preventing war. It was trained at Redstone Arsenal. Other Redstone groups are in training at Fort Bliss, Texas. The missile, its launching equipment, and fuel are quickly moved to a launch site in a truck convoy. With the help of a lightweight "A" frame "H" frame suspension system the missile is raised to a vertical position on its launching pad. Alcohol used as fuel and liquid oxygen used as oxidizer are pumped into huge tanks in the center of the missile. After the pre-flight checkout and fueling, the Redstone is leveled and turned on its launcher so that the stabilized platform -- the heart of the guidance system -- is oriented accurately in the direction of the chosen target. A field firing panel is set up in a nearby foxhole. Because liquid oxygen boils at minus 183 degrees Centigrade, some is lost from the fuel tanks because of the high rate of evaporation at normal temperatures. This is replaced continuously until just before liftoff. Liquid oxygen is manufactured in the field with mobile equipment. As firing time draws nearer, all equipment is removed from the area except the missile on its launching pad and the firing panel in its nearby foxhole. With an ear-splitting roar flames burst from the exhaust nozzle. The

Redstone rises slowly and majestically at first, then accelerates to several times the speed of sound.



silent sentinels...

THE NIKE AIR DEFENSE MISSILES

In case of an enemy air attack on this country, metropolitan areas and defense installations would be protected by the Nike family of missiles, developed under cognizance of the Army Rocket and Guided Missile Agency.

The Nike-Ajax was the Army's first supersonic antiaircraft guided missile designed to meet and destroy an enemy plane regardless of its evasive action. It was the first guided missile system to be placed in defense of key areas against air attack.

Originally the Nike-Ajax was designated simple "Nike." It was named after the Greek goddess of victory. The development program was extraordinarily successful, and over the years other and far more effective members of the Nike family have evolved. The original weapon was renamed Nike-Ajax, and a greatly improved version became known as Nike-Hercules. Still another, a "third generation" weapon, is in the development stage. It is the Army's Nike-Zeus anti-missile missile.

The Nike-Ajax project was started in 1945. Firing tests began in the fall of 1946. The first Nike-Ajax battery was installed at Fort Meade, Md., in December, 1953. Since that time this air defense weapon has been placed in dozens of areas in the United States and in allied countries overseas.

The system was developed by a service-industry team composed of the Army, Western Electric Company, Bell Telephone Laboratories, and Douglas Aircraft Company. Essentially, the Nike-Ajax system consists of two parts: an expendable missile, and ground-based launching and control equipment.

The Nike-Ajax is a liquid-fueled supersonic antiaircraft guided missile, with a solid propellant booster, totaling about 20 feet long and one foot in diameter. It has two sets of fins for steering. The missile and its booster weighs slightly more than one ton. It is normally fired from an almost vertical position, and the booster drops off in a selected disposal area. It can meet an attack from any direction.

The ground equipment includes three radars, a computer, automatic plotting boards, remote control launching racks, and power generators. One of the three radars is an acquisition or search radar which detects the approach of distant aircraft. Warning systems beyond our borders are tied in with Nike sites to alert crews of approaching aircraft. The second radar takes over the designated target while it is still many miles distant, and feeds information on its location and movement into the computer. At the appropriate moment, a missile is launched. The third radar is trained on the missile, and also feeds information to the computer. Guidance is given the missile moving faster than the speed of sound, to intercept and destroy the plane, regardless of its change in course. The aerial duel is over in a very few minutes.

The second generation Nike-Hercules is stronger, faster, and more deadly than the Ajax. Twenty-seven feet long, it has four solid propellant boosters to hurl the missile into the air almost instantaneously. Its sustainer engine also uses solid propellant. Although longer and more than double the diameter of the Ajax, it is far more maneuverable. Its higher velocity permits swifter interception of the most advanced types of aircraft. Carrying a conventional or nuclear warhead, it can destroy a single plane or an entire formation. Its full capability has

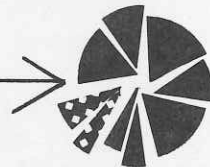


has never been realized, as it has shot down the most advanced target drones available.

The third generation Nike-Zeus is the nation's only anti-missile missile system under development. Much of this system is in the hardware stage. The solid propellant booster for the Zeus, which develops several hundred thousand pounds of thrust in a few seconds, has been successfully static-tested several times at the Army Rocket and Guided Missile Agency's test bays. The Zeus will use radars of far greater capacity than its younger brothers.

tree-top clipper...

HAWK AIR DEFENSE MISSILE



The versatile Hawk guided missile is designed to complement the defense against high-level air attack provided by the Army's Nike family. It is capable of destroying attackers flying at even the lowest altitudes, at distances far enough out to insure effective protection of the defended areas.

The missile, using a solid-fuel propellant, is about 16 feet long and 14 inches in diameter. Highly mobile, it may be moved over the highway, by helicopter, or by aircraft. The Marines will also use the Hawk.

The Army Rocket and Guided Missile Agency is responsible for developing the Hawk system, and Raytheon Manufacturing Company is the prime contractor.

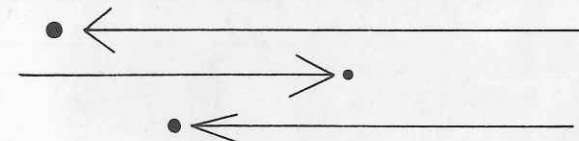


bunker debunker...

LACROSSE GUIDED MISSILE

The LaCrosse gives a battlefield commander a close support surface-to-surface weapon with which he can pinpoint targets for destruction. Highly mobile, the missile is carried and fired from a launcher mounted on a standard Army truck. Calls for fire can be answered in the same time as required for conventional artillery, and with rapidity comparable to that of the 105mm howitzer. The three basic units of the system are: the missile, the launcher, and a guidance station.

The missile is 19 feet long and 20 inches in diameter. It has four sweptback wings and four fins for guidance. Solid propellant fuel is used, and the field commander is given a choice of warheads. The LaCrosse system was developed under technical direction of the Army Rocket and Guided Missile Agency by Cornell Aeronautical Laboratory. The Martin Company has been awarded a production contract. The first troops to be trained in the LaCrosse formed two Field Artillery battalions at Fort Sill, Okla., in June, 1959.



NATO booster...

JUPITER BALLISTIC MISSILE

The largest weapon for which the Army has development responsibility is the Jupiter. Developed by the same Army Ballistic Missile Agency team which fielded the Redstone, the Jupiter has pinpoint accuracy against targets at ranges up to 1500 nautical miles. Its reliability and accuracy have been proven in numerous flight tests. The missile is 58 feet in length, and 105 inches in diameter. The smooth cylindrical body has no wings or fins. The motor is gimballed to correct changes in course. The aft section of the body is corrugated for extra strength. Burning kerosene and liquid oxygen, its single engine develops 150,000 pounds thrust.

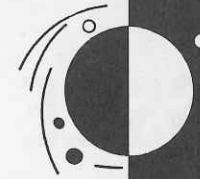
A number of "firsts" have been accomplished in the Jupiter development program. The Jupiter was the first United

States intermediate range ballistic missile to be launched. In May, 1958, the Army Ballistic Missile Agency launched and made the first recovery, with the assistance of the Navy, of a full scale heat-protected nose cone flown the full range of the missile.

This demonstrated that a practical solution had been found for the heating problem faced during re-entry, caused by aerodynamic friction and pressure.

The feat was repeated in July, 1958. A scale model of the cone, launched by the Jupiter C, was successfully recovered from the Atlantic in excellent condition August 7, 1957. The Jupiter will be fielded by the Air Force.

The first Strategic Missile Squadron to complete training at Redstone Arsenal is scheduled to be deployed in Europe in 1959, to increase the strength of NATO forces.



satellite launcher... JUPITER C

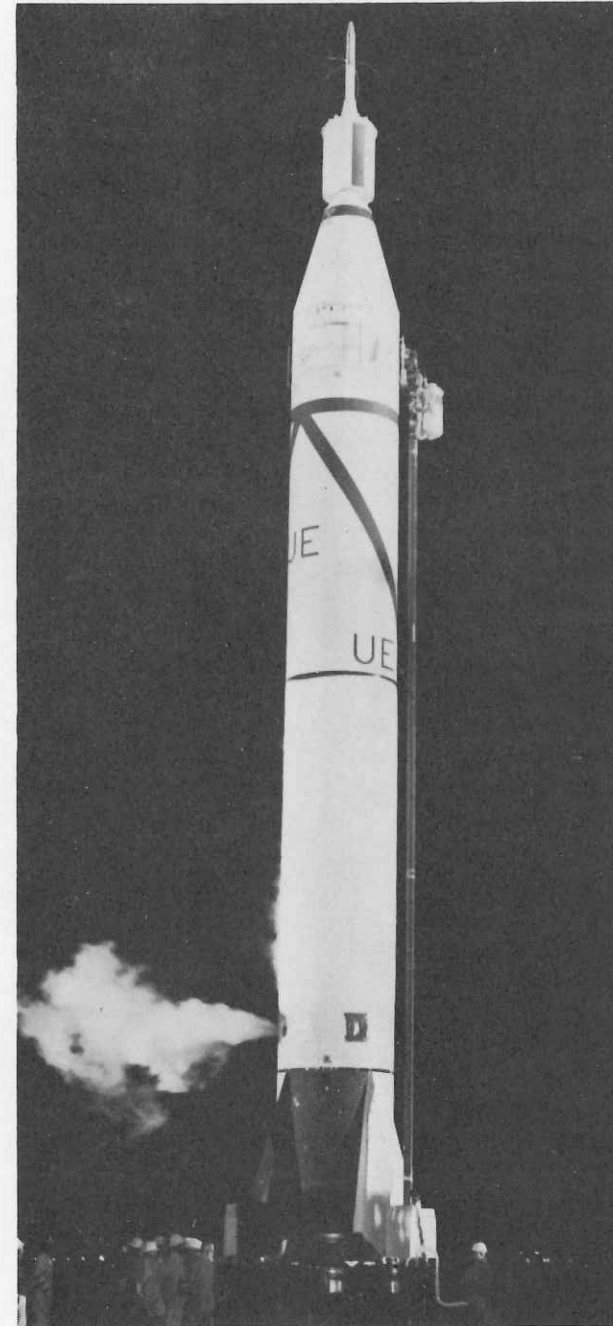
Jupiter C is short for Jupiter Composite Re-entry Test Vehicle. It is a four-stage rocket vehicle developed by the Army to test solutions to the aerodynamic heating problem faced by the Jupiter missile's nose cone on re-entering the earth's atmosphere from outer space.

Its main stage is a modified Redstone Ballistic Missile -- not a Jupiter. The Jupiter was in the early stages of development when the first Jupiter C was fabricated. Second, third, and fourth stage solid propellant motors are added to the first-stage liquid-fueled Redstone. There are 11 scaled-down Sergeant motors in the second stage, and three in the third, arranged in cylindrical clusters. The fourth stage is a single motor.

The Jupiter C measures almost 69 feet in length. The main stage is about 56 feet long and 70 inches in diameter. The high-spinning upper assembly measures 12 feet and six inches in length.

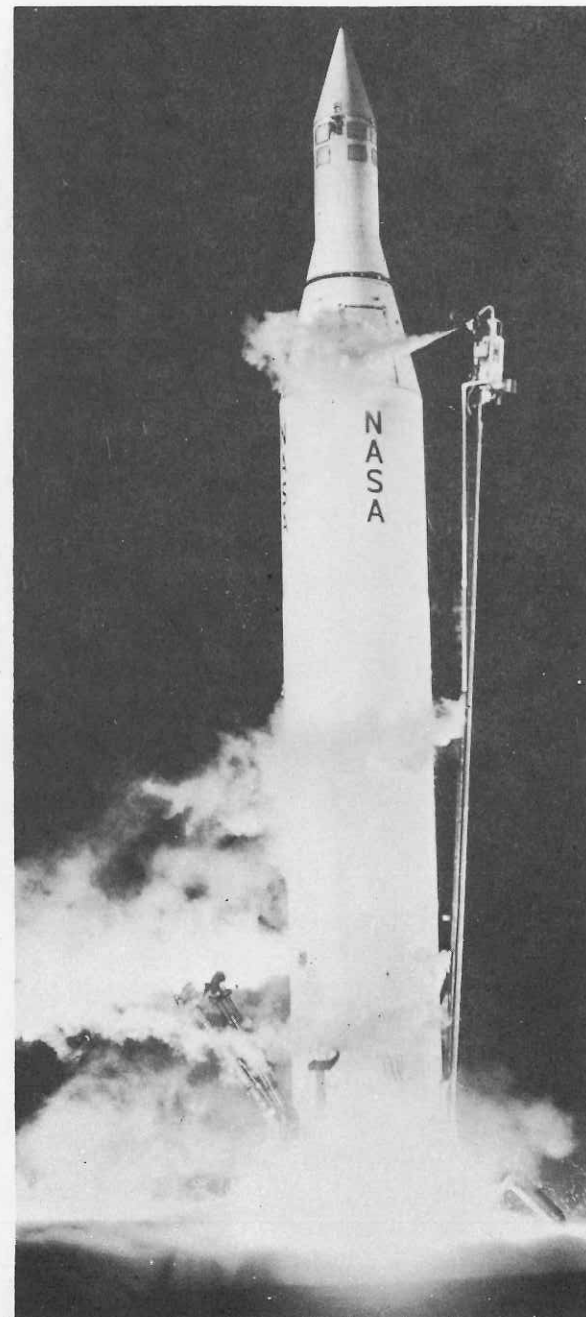
The first launching of this hybrid bird was on Sept. 26, 1956. It hurled an inert payload more than 3,000 miles downrange from Cape Canaveral, Fla. On Aug. 7, 1957, the Jupiter C propelled a scale-model nose cone of the Jupiter more than 1200 miles downrange with a summit altitude of more than 600 miles. The cone was recovered and later displayed by the President of the United States on a nationwide television program in November, 1957.

Jupiter C was designed and fabricated initially by the Army Ballistic Missile Agency and the Jet Propulsion Laboratory. The Missile Agency furnished the main stage, the highly efficient guidance and control system, and fired the vehicle; JPL provided the high-speed upper assembly.

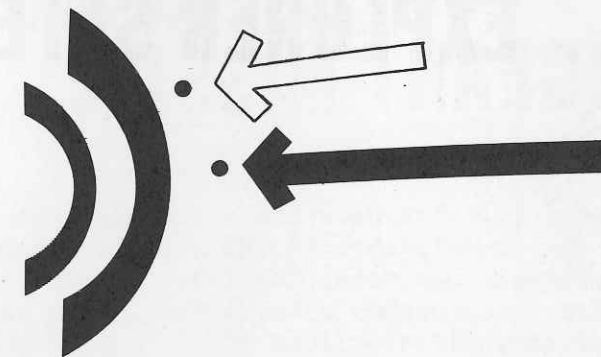


reaching toward the moon...

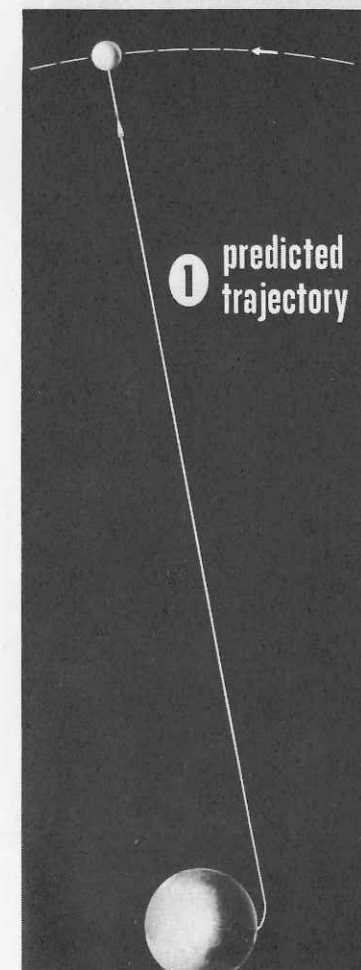
A modified Jupiter missile served as the first stage of the Army-NASA Juno II space probing vehicle. Built for this purpose by the Army Ballistic Missile Agency, the Jupiter was topped with upper stages and a scientific payload provided by Jet Propulsion Laboratory of the National Aeronautics and Space Administration. The Juno II measures 76 feet in height, and weighs 60 tons when fueled. The upper-stage assembly consists of the scaled-down solid propellant Sergeant engines used in Jupiter C. The spinning assembly is covered during ascension through the atmosphere, however, by the addition of a protective shroud. The payload is a gold-plated cone-shaped package that weighs 12.95 pounds. It contains a small radio transmitter that weighs 1.1 pounds and is powered by batteries; two Geiger-Mueller tubes to measure radiation in space; a photo electric scanner to receive reflected light from the moon, and a de-spin device to slow the payload down from its 400 RPM rotational speed as it nears the moon. The first launching of Juno II was made on Dec. 6, 1958. Cut off of fuel in the first stage 3.7 seconds too soon, plus upper stage performance not as great as expected, robbed the payload of its necessary escape speed. Pioneer III, as it was christened, did fly 63,580 miles into space, however, before being drawn back to earth by gravity. For Dr. James A. Van Allen, this was a double dividend--it measured the newly discovered radiation belts on its return as well as outward flight.



JUNO II



The second launching of Juno II on March 3, 1959, was a success in every sense of the word. Pioneer IV sped past the moon in less than 40 hours, and continued on its journey to become the first made-in-the-USA satellite of the sun. Signals were received until it reached a distance of 416,000 miles, farther than any other manmade object had been tracked.



SEQUENCE JUNO II SPACE PROBE LAUNCH

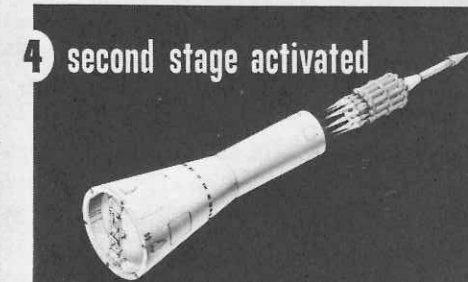
2 booster separation



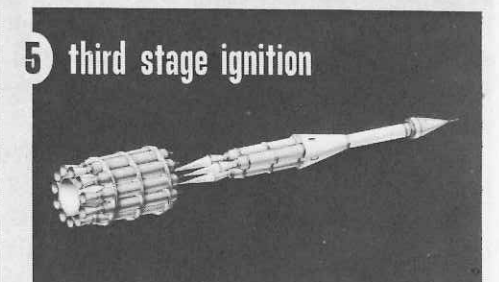
3 shroud separation



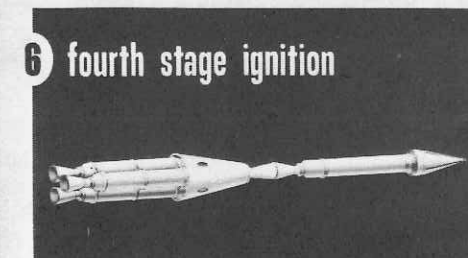
4 second stage activated



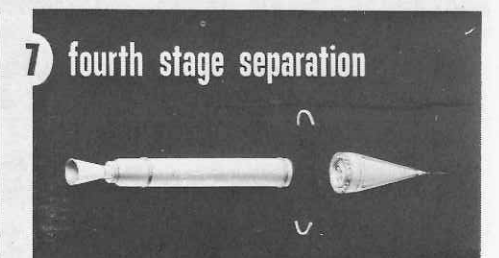
5 third stage ignition



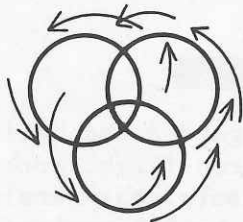
6 fourth stage ignition



7 fourth stage separation



orbiters... **EXPLORER SATELLITES**



Explorer I, the Free World's first earth satellite, was hurled aloft from Cape Canaveral on Jan. 31, 1958, by a Jupiter C vehicle. The Army Ballistic Missile Agency and Jet Propulsion Laboratory accomplished America's entry into the Age of Space for the Advanced Research Projects Agency as part of the United States' participation in the International Geophysical Year.

Explorer I, as the scientific payload was christened, is a bullet-shaped steel cylinder 80 inches long and six inches in diameter. It weighs 30.8 pounds, 11 pounds of which are scientific instruments. These include a Geiger-Mueller cosmic ray counter, two micro-meteor detector experiments, and four gauges to measure temperature inside the satellite and on its outer skin. Its perigee is 224 miles and apogee 1573 miles. It is expected to remain in orbit for several years.

Probably the most important satellite discovery of the IGY year was made by Explorer I. This is the Van Allen Radiation Belt, identified by Dr. James A. Van Allen, head of the State University of Iowa Physics Department, who designed and built the cosmic ray counters in the payload. Later measurements by Army-NASA space probes indicate that two bands or clouds of charged particles, either protons or electrons, or both, exist in space. The first radiation belt extends to 3400 miles above the earth. The second belt, about 4000 miles thick, extends some 8000 to 12,000 miles.

When these particles, streaming from the sun or other sources deep in space, reach the Earth's magnetic field, some are deflected, a few filter through and are absorbed in the atmosphere, but a great many travel in spiral paths along the magnetic field's lines of force. Dr. Van Allen concludes that the radiation belts do not extend over the Arctic and Antarctic regions. Effective lightweight shielding must be devised before man can safely travel within these belts of radiation. If it proves necessary to shun these belts entirely, entry into space via the polar regions may be feasible.

Explorer II, launched March 5, 1958, failed to achieve orbit when the fourth stage did not ignite.

Explorer III was launched May 15, 1958. Equipped with counters with greater capacity, it confirmed the radiation findings of Explorer I. It was the same size and shape as the first Explorer, but weighed 31 pounds. Its perigee was 118 miles, and apogee 1740 miles. It fell to earth the last of June, 1958.

Explorer IV was launched July 26, 1958, and is still up there. Though maintaining the same size, it was crammed with instrumentation, bringing its weight to 37.10 pounds. Its perigee is 157 miles, apogee 1380 miles.

names of the future...

Aiding the more glamorous and sophisticated guided and ballistic missiles which have been mentioned are two Army-developed free-flight rockets, the Honest John and the Little John. With no electronic controls, they are simple to operate, maintain, and fire, yet approach conventional artillery in accuracy. The Honest John, fired from a highly mobile, self-propelled launcher, delivers one high explosive round with the demolition effect of hundreds of artillery shells. It has been deployed in the United States and in Europe for several years. The Little John, only 12½ inches in diameter and 12 feet in length, can be transported easily on the ground or by helicopter. It is entering the production phase of development.

The names of other missiles will become household words as they move from the laboratories into production and into the hands of troops. Some of the newer Army missiles are:

The Red Eye, which looks like the famed bazooka anti-tank weapon, will give the Army and Marine Corps front-line foot soldier a defense against low-flying jets or conventional planes. The four-foot launching tube is the shipping container for the missile. It can be carried easily through underbrush and rugged terrain. A development contract for the Red Eye has been awarded Convair by the Army Rocket and Guided Missile Agency.

The Shillelagh is a new lightweight surface-to-surface guided missile for close-in support of troops under development by Aeronutronics Systems, Inc., of Glendale, Calif. The Ordnance Tank Automotive Command, Detroit, is responsible for development, with ARGMA as contract supervisor. Expected to become operational in the mid-1960's, the vehicle-mounted Shillelagh is expected to increase firepower against armor, troops, and field fortifications.

The SS-10 and SS-11 are anti-tank guided missiles developed by the French. They are remotely controlled, wire-guided missiles, using a solid propellant fuel. Capable of putting out of action any tank in existence today, the missiles can be hand-carried and dropped by parachutes from planes. The versatile weapons are operated by a single soldier, and can be fired from the ground, from vehicles, planes, or helicopters. Arrangements are being made with our NATO ally France for use of these systems by U. S. forces.

The Pershing is a solid-propellant, two-stage, inertially guided ballistic missile of selective range which will replace the reliable Redstone. Under development by the Army Ballistic Missile Agency, with The Martin Company of Orlando as prime weapons contractor, it will retain the mobility, field-worthiness and accuracy of the Redstone, yet will be lighter, smaller, and even more mobile. It was named in honor of General of the Armies John J. Pershing of World War I fame.

A powerful first-stage booster vehicle for space vehicles is now under development by the Army Ballistic Missile Agency. This is Project Saturn, being carried out for the Advanced Research Projects Agency. The cluster of eight Jupiter-type liquid propellant engines will develop a thrust of 1,500,000 pounds. Second stage will consist of a modified first stage of the Air Force's two-stage Titan ICBM. Third stage will be the new Centaur rocket.

The three-stage Saturn vehicle will weigh about 580 tons at lift-off, and will stand about 200 feet tall, nearly one-half as high as the Washington monument. Capable of lifting multi-ton loads into high orbit around the earth or into deep space, it is scheduled for flight testing in late 1960.

OCT 1 1959

the army's record...

DIVISIONS 81 & 82

The U. S. Army has a long and impressive list of firsts in the field of rocketry. The highlights of the Army-industry-science efforts include:

FIRST successful firing of a ballistic missile. A Corporal was launched at White Sands, New Mexico, in May, 1947.

FIRST penetration of outer space. A German V-2 boosted a second stage WAC Corporal at White Sands on February 24, 1949. It reached an altitude of 250 miles, a record which was unequaled for eight years.

FIRST intercept of an airplane by a guided missile. A Nike-Ajax shot down a remotely-controlled plane at White Sands on November 27, 1951.

FIRST operational air defense guided missile. The Nike-Ajax was placed on site near Washington, D. C., in December, 1953.

FIRST ballistic missile to be placed in the hands of troops. The 259th Field Artillery Missile Battalion (Corporal) was formed at Fort Bliss, Texas, in November, 1954.

FIRST successful launching of an Intermediate Range Ballistic Missile. The 1500-mile Jupiter was fired for the first time at the Atlantic Missile Range, Cape Canaveral, on May 31, 1957.

FIRST solution to the aerodynamic heating problem of re-entry. A nose cone from the Jupiter Composite Re-entry Test Vehicle, (Jupiter C), was recovered from the South Atlantic August 7, 1957, and was shown by the President on television in November, 1957.

FIRST Free World satellite in orbit around the earth. Explorer I was launched from Cape Canaveral, Fla., on January 31, 1958, again by a Jupiter C -- only 83 days after the order to try.

FIRST intercept of a high altitude target by a guided missile. A Nike-Hercules destroyed a rocket-launched parachute target at an altitude of more than 100,000 feet and 35 miles from its launching site.

FIRST intercept of an F-80 jet flying at tree-top level, and below the effective range of conventional radar, was made by a Hawk guided missile in May, 1958.

FIRST made-in-the-USA satellite of the Sun. Pioneer IV, a 13.4-pound gold-plated and heavily instrumented payload, was launched by a Juno II from Cape Canaveral, Fla., on March 3, 1959, under direction of the National Aeronautics and Space Administration.

FIRST successful flight of primates into outer space. Two monkeys, Able and Baker, rode in a Jupiter nose cone on May 28, 1959, to an altitude of 300 miles and a distance of 1500 miles, successfully withstanding 38 times the normal pull of gravity and a weightless period of nine minutes.